NUS CORPORATION
992 OLD EAGLE SCHOOL ROAD, SUITE 916
WAYNE, PENNSYLVANIA 19087
215-687-9510

SDMS DocID 2221738

our 25 year

ORIGINAL (Red)

February 3, 1986
T-585-2-6-2
68-01-6699

Mr. Harold Byer
U.S. Environmental Protection Agency
841 Chestnut Building
Ninth and Chestnut Streets
Philadelphia, PA 19107

Dear Mr. Byer:

Attached please find four final copies of the Target Population Study on Gulf Oil Sinking Spring, prepared under TDD No. F3-8508-09.

Please endorse below confirming that you have received the attached subject data and return the form to the above address.

Sincerely,

Garth Glenn/nmd

Garth Glenn
Manager, FIT III

GG/nmd

Attachments

Signature: Harold G Byer
Harold Byer

Date: 2/5/86

arg.

NUS
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[redacted]

PROJECT FOR PERFORMANCE OF REMEDIAL RESPONSE ACTIVITIES AT UNCONTROLLED HAZARDOUS SUBSTANCE FACILITIES—ZONE 1

NUS CORPORATION
SUPERFUND DIVISION

ORIGINAL (Red)

R-585-12-5-4

TARGET POPULATION STUDY REPORT
GULF OIL SINKING SPRING

PREPARED UNDER

TDD NO. F3-8508-09
EPA NO. PA-1046
CONTRACT NO. 68-01-6699

FOR THE

HAZARDOUS SITE CONTROL DIVISION
U.S. ENVIRONMENTAL PROTECTION AGENCY

JANUARY 31, 1986

NUS CORPORATION
SUPERFUND DIVISION

SUBMITTED BY	REVIEWED BY	APPROVED BY
Michael P. Cramer	Richard M. Cromer	Garth Glenn
MICHAEL P. CRAMER GEOLOGIST	RICHARD CROMER ASSISTANT MANAGER	GARTH GLENN MANAGER, FIT III

ORIGINAL (Red)

Site Name: Gulf Oil Sinking Spring
TDD No.: F3-8508-09

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ATTACHMENTS

ORIGINAL
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SECTION 1

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Site Name: Gulf Oil Sinking Spring
TDD No.: F3-8508-09

1.0 INTRODUCTION

1.1 Authorization

NUS Corporation performed this work under Environmental Protection Agency Contract No. 68-01-6699. This report was prepared in accordance with Technical Directive Document No. F3-8508-09 for the Gulf Oil Sinking Spring site located in Sinking Spring Township, Berks County, Pennsylvania.

1.2 Scope of Work

NUS FIT III was tasked to perform a target population study of the area within the 3-mile radius of the Gulf Oil Sinking Spring Terminal site. The project includes surface water and groundwater use in the area, the areal distribution of public water supply systems in the area, performance of a geologic and hydrologic evaluation of the area to establish the potential population which may be affected by the groundwater and surface water contamination caused by the Gulf Oil Sinking Spring Terminal site.

1.3 Summary

The Gulf Oil Sinking Spring Terminal site is located just southwest of Sinking Spring Township, Berks County, Pennsylvania (attachment 5, figures 1 and 2). The site is in the Cacoosing Creek watershed, which is a tributary to the Schuylkill River. The site is underlain by the Richland Formation, which consists chiefly of limestone and dolomite.

The site is an inactive petroleum transfer station, which operated under a Pennsylvania Department of Environmental Resources (PA DER) permit.

There are several public water supply wells documented within the 3-mile radius of the site (attachment 5, figure 1). Homes within 3 miles of the site are served by private wells and municipal surface water and groundwater supplies. Home wells within the study area utilize several different formations, which are hydrologically connected, as their water source.

The aquifer of concern in the study area is utilized by 40,490 of the 45,000 persons living within 3 miles of the site.

Cacoosing Creek and the surface water that intersects it downstream within the study area are not listed by the Pennsylvania Fish Commission as stocked creeks.

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SECTION 2

2.0 ENVIRONMENTAL SETTING

2.1 Site Location

The site is located on Mountain Home Road, at the bottom of a hill which rolls toward Cacoosing Creek. The site is approximately 1/2 mile southeast of Sinking Spring Borough (attachment 5, figure 1). The coordinates are 40° 19' 00" and 76° 12' 01".

2.2 Surface Water

Cacoosing Creek, which merges with Little Cacoosing Creek 1.8 stream miles north of the site, flows into Tupelhocking Creek. Tupelhocking Creek flows southeast into the Schuylkill River. Surface water within 3 miles downstream of the site is limited to the Cacoosing and Little Cacoosing Creeks (attachment 5, figure 1). Cacoosing Creek receives surface drainage from this site. The creek is 150 feet from the site boundary. Use of surface water 3 miles downstream was not determined, except that they are not listed by the Pennsylvania Fish Commission as stocked creeks.

2.3 Geology

The site is underlain by alluvial deposits, residual limestone clay, and gray limestone bedrock (see attachment 3 for information provided by the site representative to FIT III). This limestone is the Ontelaunee Formation, a member of the Beekmantown Group. The Ontelaunee Formation is light to dark gray, very fine- to medium-grained crystalline dolomite with interbeds of bluish gray limestone; nodular dark gray chert occurs at the base of the formation. Below the Beekmantown Group is the Conococheague Group, which consists of massive beds of limestone and dolomite of Cambrian age.

Soils weathered from parent rocks in the area of the site are of the Duffield Series and the Melvin Series. The Duffield silt loam consists of deep, well drained, nearly level to steep soils formed from the underlying, impure limestone. The Melvin silt loam consist of soils that are poorly drained and nearly level. These soils have formed from alluvium derived from sediment originating in uplands underlain by limestone and calcareous shale. The moisture capacity of both series is high, and the effects of erosion are slight or none.

The geology contained within the 3-mile radius surrounding the site is quite complex. The various formations present have been scattered about in a patchwork-like fashion. The forces necessary to produce this haphazard array were generated by several tectonic events. A description of the formations contained within the 3-mile radius is presented as follows.

Precambrian

Granite gneiss and granite - These intrusions, described as being medium to coarse grained, appear in 3 small areas within the south-central portions of the study region. Being gneissoid in some spots, they characteristically contain a porphyritic texture. The chief mineral constituents are quartz, feldspar, biotite, and hornblende.[1,2]

Lower Cambrian

Hardyston Formation (Cha) - This 600 feet thick formation is reported to contain quartzose and feldspathic sandstones and quartzites, with conglomerate occurring near the base. The Hardyston is found in 2 rather large areas in the southwest and southeast portions of the study region.[1,6]

Middle Cambrian

Buffalo Springs Formation (Ebs) - This interbedded limestone and dolomite occupies only a small portion of the study area to the southeast. Its color ranges from light gray to pinkish gray and its thickness is reported to be greater than 500 feet.[1]

Upper Cambrian

Millback Formation (Om) - The Millback is represented by a rather broad band crossing through the south central portion of the 3-mile radius. Described as an interbedded limestone and dolomite, its color is characteristically light gray, though occasional pinkish gray portions do exist. Conglomerates are also reported to be widely distributed throughout the formation. The Millback is thought to be greater than 1,000 feet thick.[1]

Richland Formation (Or) - Reported to be 1,700 feet thick within the study region, this formation consists of gray, thickly bedded dolomite. Interbedded within are smaller beds of limestone. Limestone is thought to be more prevalent towards the middle of the Richland, and is described as dolomitic and sandy towards the base. This formation occupies 2 bands, 1 broad, the other somewhat thinner, both trending approximately east-west across the region.[1]

Both the Richland and the Millback Formations are members of the Conococheague Group.[1]

Lower Ordovician

Rickenbach Formation (Or) - This cherty dolomite, which contains interbedded limestone, is described as being medium to medium-dark gray in color and is approximately 600 feet thick. Rickenbach occurrence is limited to a small area in the northeast section of the 3-mile radius.

Epler Formation - The 800 feet thick Epler Formation is reported to be composed of interbedded limestone and dolomite, which contains lines of calcarenite. Its color is reported as medium gray. The formation occurs in several small patches in the northern region of the 3-mile radius.

Ontelaunee Formation (Oo) - This medium-dark gray dolomite is reported to be interbedded with medium gray, mottled limestone. Dark gray chert beds may occur near its base. The thickness of the Ontelaunee is estimated to be between 600 and 700 feet and occupies a rather large body centrally located within the study region.[1]

The Rickenbach, Epler, and Ontelaunee Formations are all members of the Beekmantown Group.[1]

Middle Ordovician

Myerstown Formation (Omy) - This formation, which ranges in thickness from 0 to 200 feet, is described as a gray, thin bedded, crystalline limestone, and is carbonaceous at its base. This formation occupies only a very small portion to the west within the 3-mile radius.[1]

Hershey Formation (Ohy) - The Hershey, being a dark-gray argillaceous limestone, ranges in thickness from 800 to 1,200 feet. A dolomite conglomerate is found in the lower portions of the formation. As with the Myerstown, it occupies only a very small extent within the western portion of the study area.[1]

Lithotectonic unit 6 (Oh6) - This unit, of unknown thickness, is composed of siltstone, claystone, and shale which are greenish-brown in color. Interbedded with the above, limestone and a brown quartz-pebble graywacke conglomerate are found. Areal extent is limited to several small masses near the center of the study area.

Lithotectonic unit 8 (Oh8) - Situated to the northwest, this unit's thickness is also undetermined. It consists of gray shale, which weathers to a buff or olive color, and is interbedded with fine-grained graywacke.

Middle and Upper Ordovician

Martinsburg Formation (Om) - The Martinsburg is composed of 3 members, the Pen Argyl, the Ramseyburg, and the Bushkill.

Bushkill Member (Omb) - This 4,000 feet thick claystone slate is described as thin bedded and dark to medium gray in color. Interbedded within are graywacke siltstone, carbonaceous slate, and dolomite siltstone near its base.

Ramseyburg Member (Omn) - This member is reported to be an interbedded sequence involving a medium- to thick-bedded, graded graywacke with a graywacke siltstone. Its color ranges from dark to medium gray and the thickness is estimated to be 2,800 feet.[1]

Pen Argyl Member (Omp) - Consisting of dark-gray to grayish-black, thick-bedded claystone slate, this member is reported to be 3,000 to 6,000 feet thick. Interbedding of quartzose slate and carbonaceous claystone slate is reported.[1]

All of the above members weather from a medium-gray to yellowish-brown color. Within the 3-mile radius, 2 small masses of the Martinsburg outcrop in the south, and it is assumed that the individual members are indifferentiable at these locations. Two outcrops of the Bushkill member have been identified in the northwest portion of the region.[1]

Triassic

Hammer Creek Formation (Trh) - This formation represents an interbedded sequence of red, brown, and gray sandstone, fine to coarse conglomerate, and red shale. The most common lithology within the formation is a brown sandstone whose bedding thickness can range from 1 to 2 inches, and up to a foot or more. The thinner bedded varieties tend to be fine grained. Conglomerate portions tend typically to be thick bedded and occasionally massive. Ground mass generally comprises 50 percent of the conglomerate, while cobbles up to 5 and 6 inches in diameter may be present in the thicker beds. In general, the bedding of all lithologies tends to be lens shaped, and discontinuous in all directions, yet individual beds may extend for several thousand feet. The Hammer Creek occupies a large areal portion within the southern region of the study area.[6]

Triassic Diabase (Trd) - This medium-grained, crystalline, shallow intrusion rock is reported to be derived from a Basaltic magma. Occurring as dikes within the study region, several thin intrusions are located in the central and northern regions, while a large dike exists in the south.[1,3] The rocks' speckled appearance occurs as a result of the distribution of light plagioclase and dark pyroxene and olivine.[1,3]

Intense folding and thrust faulting represent the major features which have created the complex structural geology of this area. Before presenting a discussion of the structures found, the following definitions are presented in order to help make the section more meaningful.

The term "thrust fault" generally describes a reverse fault which dips at an angle of less than 45 degrees. This low angle of dip often will position older rocks over top of younger ones. "Thrust" or "slide" refers to the movement surface, while the terms "thrust sheet" and "nappe" describe the unit above the movement surface. "Nappe," an abbreviation for the French word "nappe de recovement," is used geologically to describe large, sheet-like geologic bodies, which cover lower rocks tectonically. Tectonic outliers, which are isolated outcrops surrounded in map pattern by tectonically lower rocks, have been given the term "klippe." The major structural feature has been described as "great recumbent anticlinal detachments." This description refers to an anticline which has had its axial plane turned near horizontal and was then later crosscut by a thrust fault. The result of this deformation will often be a relocation of a portion of the overturned anticline.[1,4]

Within the study region, the Lehigh Valley Sequence, referred to as the Irish Mountain Nappe, contains the Beekmantown Group. The Buffalo Springs Formation, Conococheague Group, Beekmantown Group, Meyerstown Formation, and Hershey Formation belong to the Lebanon Valley Sequence, representing the Lebanon Valley Nappe. Both sequences also contain granite gneiss and granite of the Precambrian and the Hardyston Formation. Each of these nappe systems contains rock sequences characteristic of their exposure area. The Irish Mountain Nappe and the Lebanon Valley Nappe interact in the site area, and both were derived from the same carbonate shelf.[1]

It is reported that, on the west of Sinking Spring, the Irish Mountain Nappe was overridden by the lower link of the Lebanon Valley Nappe. In later deformation, both of these units were in turn overridden by rocks of the upper limb and core of the Lebanon Valley Nappe. During both events, the rocks advanced as subunits, along internal thrusts of various magnitudes, rather than as a single unit.

Lithotectonic units 6 and 8, part of a group known as the Hamburg sequence, are also referred to as the "Hamburg Klippe." This sequence was originally deposited upon a northwest-facing bank in the Proto Atlantic. Tectonic events broke the sequence into blocks which slid deeper into this ocean. In later deformation, these blocks, stacked in their present order, were then thrust upon the Martinsburg Formation, forming a large, structurally complex sheet.[1]

The Taconic and Alleghanian orogenies are reported to have produced the major displacements in the region. The general structural trend is southwest to northeast and the dominant deformational force is reported to have come from the south and southeast. Dips range from 20 to 80 degrees, and some represent overturned strata.[1]

It should be noted that rocks of the Triassic exhibit different structural relationships than the other formations previously discussed. The Newark Group, of which Hammer Creek is a member, consists of a thick sequence of Triassic sediments. These sediments filled the Newark-Gettysburg basin. Forming a homoclinal structure, the Newark dips northwestward, and is broadly warped. Dips are reported to range from 15 to 20 degrees. The petrography and depositional structure of the Newark are reported to indicate derivation from Paleozoic sediments, which were located north and northwest. The Hammer Creek represents a relatively coarse member within the group and is thought to represent the deposits of a major stream system. The conglomerate portions of Hammer Creek would seem to represent localized alluvial fans, or perhaps mudflow deposits.[6]

2.4 Groundwater

Within the study region, the majority of groundwater is found in the bedding planes. joints, faults, and fractures, representing the secondary openings (see attachment 4). Water-bearing zones generally decrease with depth to approximately 300 feet. While the secondary openings in carbonate rocks also decrease with depth, they tend to exist farther below land surface than those in other formations. Solution has enhanced these openings, helping to explain the presence of water-bearing zones at greater depths. Conversely, the igneous and metamorphic species that are present contain jointing which generally decreases rapidly with depth, resulting in lower yields.[1,2,5]

It is reported that shale members with the highest transmissivities are those units which contain portions of limestone and dolomite. However, carbonates with the lowest transmissivities are those members which contain significant amounts of shale, and/or large clayey fractions. Those formations contained within the Conococheague and Beekmantown Groups, which occupy significant portions of the study region, are reported to be good to excellent aquifers.[1]

As shown in attachment 4, groundwater flow, at least within the carbonates, is generally expected to be to the northeast.

Figure 1, attachment 5, indicates those portions within the 3-mile radius which have been excluded from the aquifer of concern. From this map, we can observe that the entire extent of the Hammer Creek Formation, represented by areas 2 and 3, the major dike which borders the Hammer Creek Formation, and a large body of granite gneiss, to the west represented by area 1, have all been omitted. The rationale behind these exclusions is as follows:

1. The nature of the Hammer Creek Formation is such that the beds are lens shaped and discontinuous. The cyclic sequences observed cause permeability to differ substantially from 1 bed to another. Outcrops indicate that, where sandstone units are emplaced between shales, the hard sandstones tend to develop jointing, while the shales tend to deform without breaking. Within the thicker beds of sandstone and conglomerate, joints are few as a result of greater competency. Hydraulic interconnection between individual aquifers is reported to be poor.[7]

2. Diabase weathers to a maximum of approximately 30 feet and the majority of water storage occurs within this zone. Water movement occurs through the joints, the size of which tends to decrease rapidly with depth. Fractures rarely exist below 150 feet and there is very little primary porosity. Gneiss, also an impervious rock, displays water-bearing properties similar to those of igneous species.[2,7]

3. The portion of the study area excluded from the aquifer of concern has not been subjected to the same intense deformational processes that the rocks in the northern regions have undergone.[1,6]

Considering the above discussion, the remainder of the 3-mile radius has been identified as the aquifer of concern. The large number of faults and fractures which cross cut the remainder of the area, represent secondary porosity features and allow for the hydraulic interconnection of the remainder of the area. It should also be pointed out that, in addition to the faults and fractures mapped, numerous others could possibly exist which, at present, may be concealed.[1] As presented in the water contour map in attachment 4, water levels indicate a continuous table throughout the like formations within this area.

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SECTION 3

3.0 WATER SUPPLIES

3.1 Groundwater

(b) (9) [redacted] (b) (9) [redacted]

[redacted]

[redacted]

[redacted]

Industrial and commercial service is provided by private wells and the above mentioned water companies and authorities.

3.2 Surface Water

Shillington Borough Water Department supplies water to Montrose (1,500 persons) and Lincoln Park (1,500 persons). Shillington Borough Water Department purchases surface water from Reading Water Company, whose surface water intakes are outside the study area.

Cacoosing and Little Cacoosing Creeks are not used for water supplies, nor do they serve as recreational streams. One section of the study area is served by surface water from surface water supplies outside of the 3-mile radius.

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SECTION 4

4.0 POPULATION ANALYSIS

4.1 Population Served by Aquifer of Concern

The aquifer of concern is defined as the 3-mile radius, except as shown on attachment 5, figure 1. The population of the entire 3-mile radius, from a house count, is estimated to be 45,109 people. As noted in Section 2.3 and shown on attachment 5, figure 1, 426 houses outside of the aquifer of concern equals 1,619 persons. In addition, 3,000 people are served by Shillington Water Authority; their water source is outside the 3-mile radius of the subject site. The remainder of the population is serviced by public water from within the aquifer of concern or are on private wells within the aquifer of concern. This population of 40,490 is therefore the target population.

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SECTION 5

ORIGINAL (Red)

5.0 REFERENCES

1. Wood, Charles R. and Machachlan, David B., Commonwealth of Pennsylvania Department of Environmental Resources. Geology and Groundwater Resources of Northern Berks County, Pennsylvania. Water Resources Report 44, 1978.

2. Hall, George M., Commonwealth of Pennsylvania Department of Environmental Resources. Groundwater in Southeast Pennsylvania. Water Resources Report 2, 1934.

3. Bell, Pat, and David Wright. Rocks and Minerals. Macmillan Publishing Company, New York. 1985.

4. Dennis, John G. Structural Geology. The Ronald Press Company, New York. 1972.

5. Fetter, C.W. Jr. Applied Hydrogeology. Charles E. Merril Publishing Company, Columbus, Ohio. 1980.

6. Machachlan, David B., Traig V. Buckwalter, and Dean B. McLaughlin, Commonwealth of Pennsylvania Department of Environmental Resources. Geology and Mineral Resources of the Sinking Spring Quadrangle, Berks and Lancaster Counties, Pennsylvania. Atlas 177d, 1975.

7. Wood, Charles R., United States Geological Survey, Water Resources Division. Groundwater Resources of the Gettysburg and Hammer Creek Formations, Southeastern Pennsylvania. Water Resources Report 49, 1980.

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ATTACHMENT 1

ORIGINAL
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REM/FIT ZONE CONTRACT
TECHNICAL DIRECTIVE DOCUMENT (TDD)

1. COST CENTER:	
ACCOUNT NO.:	
2. NO.:	F3-8508-09
3. PRIORITY:	[X] HIGH [ ] MEDIUM [ ] LOW
4. ESTIMATE OF TECHNICAL HOURS:	80
4A. ESTIMATE OF SUBCONTRACT COST:	
5. EPA SITE ID:	PA1046
5A. EPA SITE NAME:	Gulfoil-Sinking Spring, Sinking Spring, PA
6. COMPLETION DATE:	10/30/85
7. REFERENCE INFO.:	[X] YES [ ] NO [ ] ATTACHED [X] PICK UP

8. GENERAL TASK DESCRIPTION: Perform a target populatin study for the subject site.

9. SPECIFIC ELEMENTS:

1.) Review background information.
2.) Review information obtained under TDD F3-8405-32.
3.) Contact state and local agencies for relevant information.
4.) Assess hydrogeologic conditions and the water supply situation for the purpose of an HRS.
5.) Refer to the attached request for additional instructions and requirements.
6.) Prepare and submit report in letter format, fully referenced & documentable w/documentation appe
7.) All work on this project to be performed according to: WP-SI-1, Rev. 1 & WP-HRS, Rev.0

10. INTERIM DEADLINES:

11. DESIRED REPORT FORM: FORMAL REPORT [ ] LETTER REPORT [X] FORMAL BRIEFING [ ]

OTHER (SPECIFY): coordinate with Laura Boornazian

12. COMMENTS: State code 042 County Code 011

13. AUTHORIZING RPO: Harold G Byer
(SIGNATURE)

14. DATE: 9/10/85

15. RECEIVED BY: [X] ACCEPTED [ ] ACCEPTED WITH EXCEPTIONS [ ] REJECTED
Garner
(CONTRACTOR RPM SIGNATURE)

16. DATE: 9/12/85

Sheet 1 White — FITL Copy Sheet 3 Pink — Contracting Officer's Copy (Washington, D. C.)
Sheet 2 Canary — DPO Copy Sheet 4 Goldenrod — Project Officer's Copy (Washington, D. C.)

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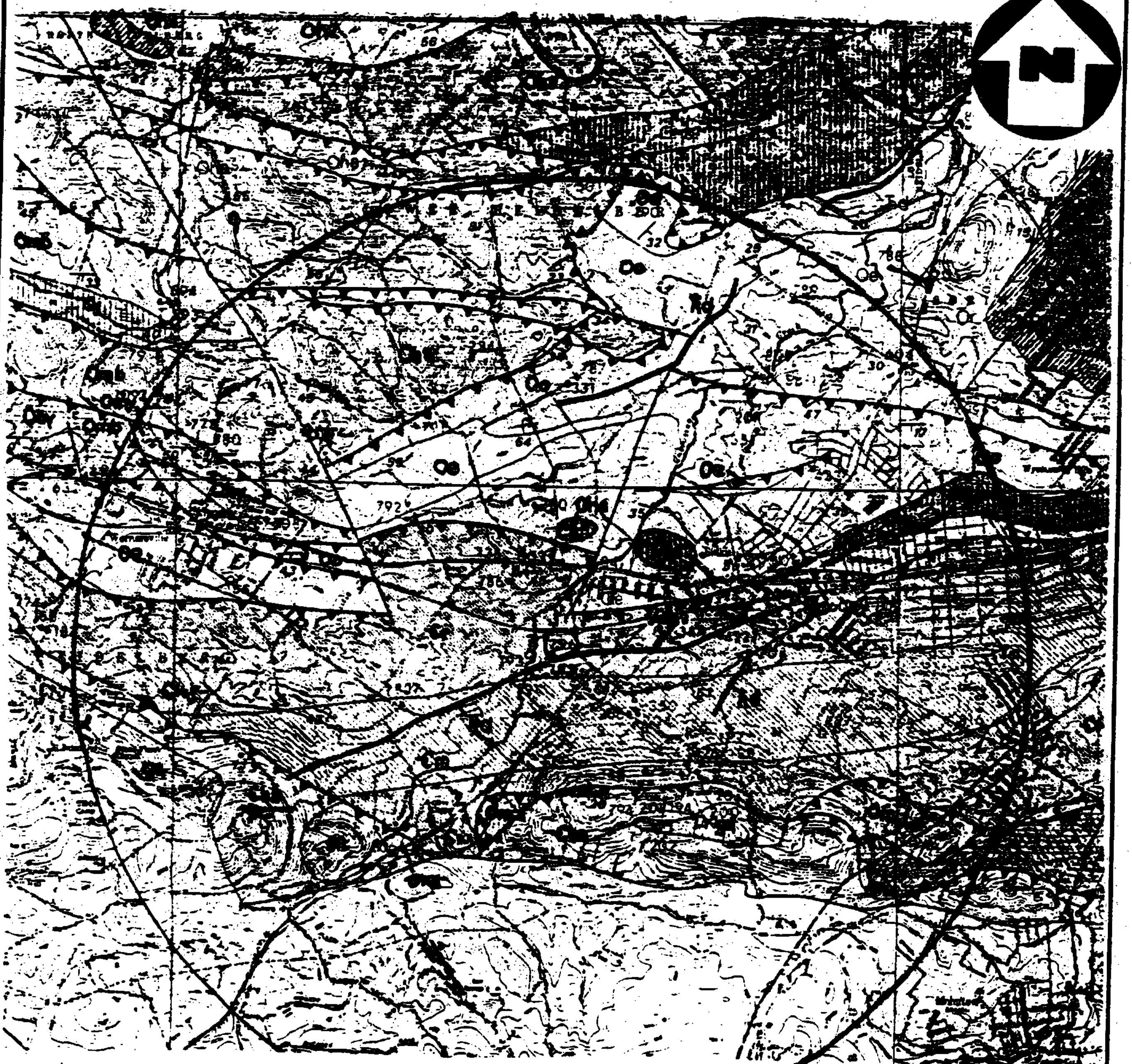
ATTACHMENT 2

ORIGINAL (Red)



Oe - Eplerfm
Oo - Ontelauneefm
TRd - Triassicdiabase
Єm - Millbachfm
Oh6 - Lithotectonicunit 6
Oh8 - Lithotectonic Unit 8
Єha - hardystonfm
Єr - Richland fm
gn - granite gneissand granite
Om - Martinsburgfm
Ohy - Hersheyfm
Or - Rickenbachfm
Omy - Myerstownfm

GEOLOGIC MAP OF AQUIFER OF CONCERN

GULF OIL-SINKING SPRING TERMINAL, SINKING SPRING, PA.

(NO SCALE)

FIGURE 18

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ATTACHMENT 3

ORIGINAL (Red)

regional ground water system.

2. Creates wells which can be used for gasoline recovery in the event that significant volumes of free gasoline have entered the regional ground water flow system.

3. Enables the static head and ground water flow direction of the regional ground water system to be determined thereby establishing risks to the environment as a result of potential downgradient migration of gasoline within the regional ground water system.

Well 1

Well 1 is located approximately 120 feet west of the spill site as illustrated in Figure 1. Figure 2 is a schematic drawing of this well which illustrates details of construction and subsurface geologic materials encountered during the drilling process. Shallow subsurface contamination was present in the form of decayed gasoline odors at depths of less than 15 feet; however, the subject spill is not the likely source of this gasoline. The probable source is minor losses from the surface pipelines and pumping station located 80 feet south of Well 1 which Gulf reports have leaked minor volumes of gasoline in the past. Only minor amounts of bedrock (less than 3 feet thick) were encountered until 100 feet, at which depth sufficient rock was encountered to set casing. The static water level on January 10, subsequent to grouting, was 8.50 feet - approximately 6 feet lower than the surface of the shallow ground water system within the alluvial gravel as evidenced by the static water level in adjacent TP-6b. The static water level of 8.50 feet represents the static head of the deeper regional ground water system, providing clear evidence of two distinctly separate ground water flow systems.

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Well 2

Well 2 is located approximately 180 feet northeast of the spill site as illustrated in Figure 1. Details of its construction are illustrated in Figure 3. Bedrock was encountered at 37 feet, thus suggesting less intense subsurface weathering and dissolution as evidenced by the reduced thickness of residual limestone mud encountered in Well 2. At 18 feet gasoline odor was present; however, it was not present while drilling through the shallow alluvial material which suggests that the deeper regional ground water system is contaminated. The static water level in this well on January 10 was 11.13 feet. To REWAI's knowledge this well has not been grouted to date.

Well 3

Well 3 is located 190 feet east of the spill site as shown on Figure 1. Details of its construction are illustrated in Figure 4. Bedrock was encountered at 37 feet and gas odors were not present throughout drilling. Absence of gas odors in this well suggest that the flow direction of the regional ground water table is generally from the spill site toward Well 2, down the topographic gradient. No measurement of the static water level in this well was made due to suspension of project work.

A very important fact concerning Wells 1,2 and 3 is related to their details of construction. As stated, adequate grouting and sealing of the wells was a necessity; therefore, solid casing (not slotted) has been installed at the top of the three wells. This solid casing (Wells 1, 2 and 3) and grout (Well 1) will not allow free gasoline floating on the regional ground water table to enter the wells until the water level in the wells is pumped down to below the grout

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seal and/or solid casing. None of the wells, to the knowledge of REWAI, have been pumped and, therefore, it is erroneous to assume that gasoline is not present on top of the regional ground water table due to its absence from "observation" Wells 1, 2 and 3.

The most significant data acquired to date by drilling the aforementioned observation wells is:

1. Gasoline odors in Well 2 were not encountered until 18 feet, after the drill bit had fully penetrated the overlying alluvial material. As stated, this suggests that the deep regional ground water system in the vicinity of Well 2 is contaminated.

2. No gas odors were encountered in Well 3, thus indicating that the flow direction of the regional ground water system is probably toward the north-northeast.

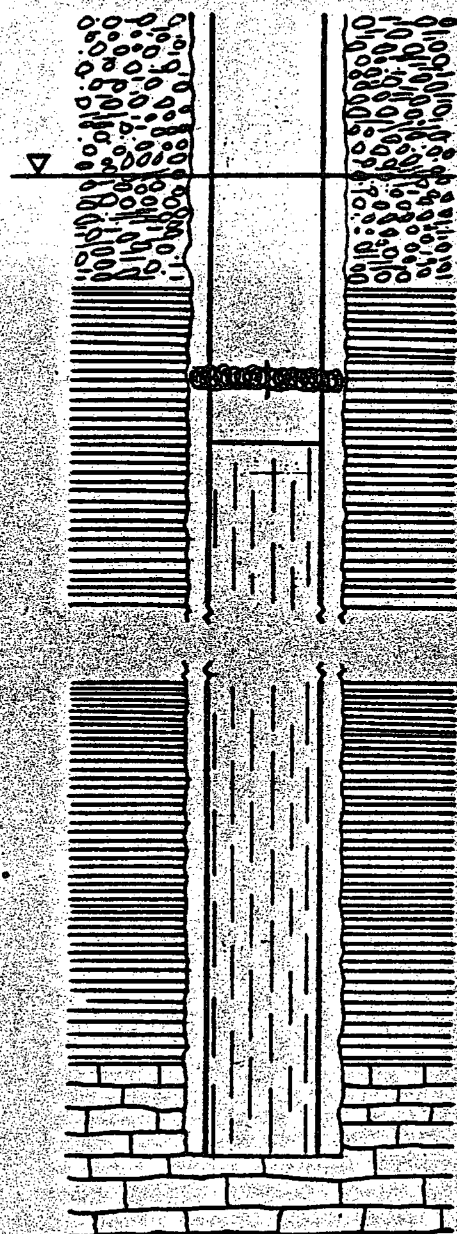
ENVIRONMENTAL IMPACT ASSESSMENT

On 1/10/79 prior to surveying the well elevations or pumping any of the observation wells, as intended, REWAI's involvement with the subject gasoline spill was suspended by Gulf Oil. In our final discussion of 1/10/79 concerning the project with Mr. Noel, Terminal Manager, it was strongly recommended that grouting of Wells 2 and 3 be completed and that minimum 24-hour pumping - sampling tests of Wells 1,2, and 3 be performed. However, Mr. Noel stated that Gulf Oil and REWAI had performed a sufficient work effort toward recovering free gasoline and protecting the hydrologic environment with little tangible (2500 gallons recovered) results and that no additional work was justifiable. Therefore, to the knowledge of REWAI, no additional work has been performed subsequent to this date (1/10/79).

Figure ORIGINAL (Red)

Well 1 Construction

8" hole to 105'
Slotted 6" casing from 22' 5" to 105'
Solid casing from surface to 22' 5"
Grouted from 22' 5" to surface with approximately 7 cubic yards of cement.
Grout composition: 3 to 1 mixture of cement and sand +3% calcium chloride.



Geologic Log

0-14' Alluvial deposits

14-100' Residual limestone clay

Minor thicknesses (<3') of limestone bedrock encountered at: 56', 59', 70', 84', 90'

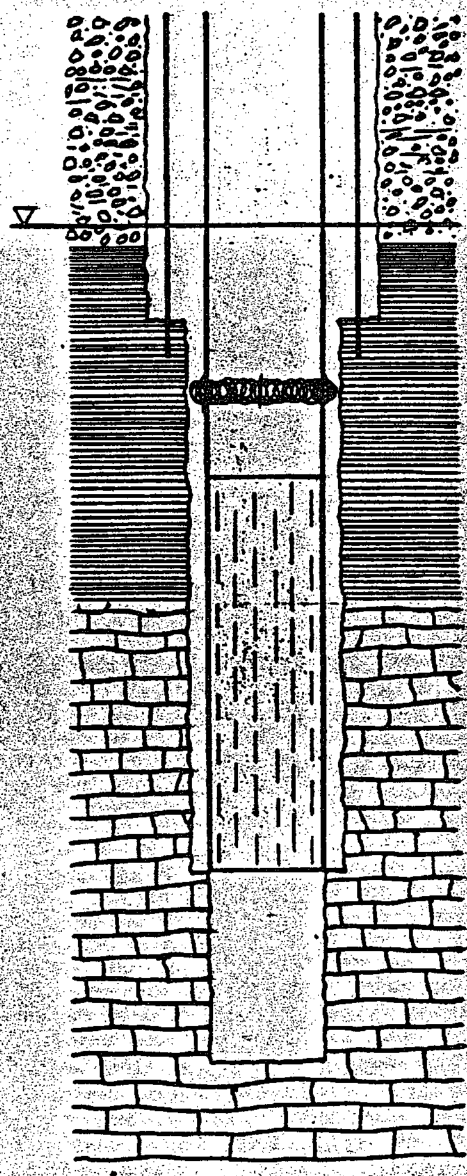
100-105' Gray limestone

Decayed gasoline odor at < 15', present throughout drilling.
Blown yield: 30-50 gpm.
Static water level: 8'6", 1/10/78.

Vertical Scale: 1 inch = 10 feet
Horizontal Scale: 1 inch = 10 inches

Well 2 Construction

12" hole to 16'
10" starter pipe from 18' to surface
8" hole to 45'
Slotted 6" casing from 45' to 24' 9"
Solid 6" casing from 24' 9" to surface
6" hole to 55'
Well not grouted.



Blown Yield: 40+ gpm
Static Water Level: 11' 1 1/2", 1/10/78
Gas odor present below 18'
No gas odor from 0-18'
No free gasoline present

Vertical Scale: 1 inch = 10 feet
Horizontal Scale: 1 inch = 10 inches

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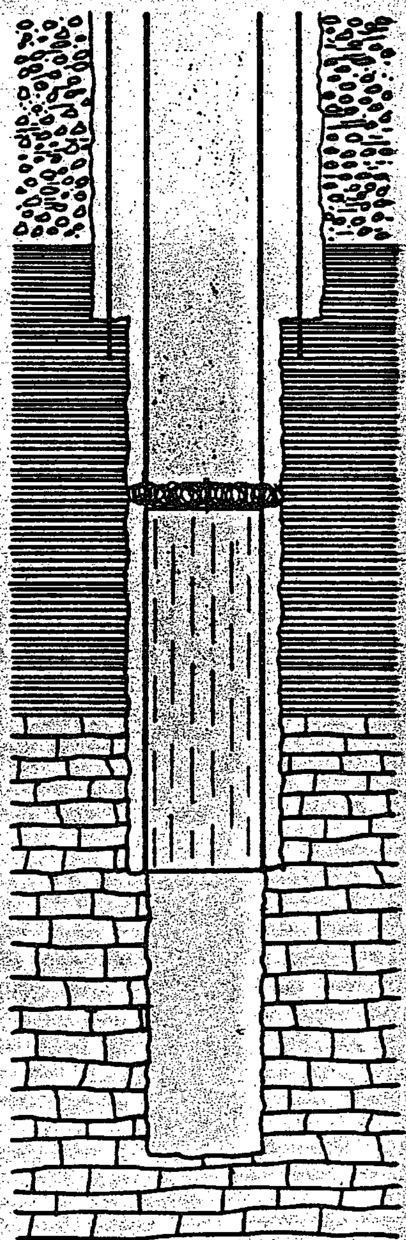
Figure 4

Well 3 Construction

12" hole to 16'
10" starter pipe from 18' to
  surface
8" hole to 45'
Slotted 6" casing from 45' to 26'
Solid 6" casing from 26' to
  surface
6" hole to 60'
Well not grouted

Flown Yield: 60 gpm
Static Water Level not known
No gas odors present
  throughout drilling



Geologic Log

0-12' Alluvial

12-37' Residual limestone clay

37-60' Limestone bedrock

Vertical Scale: 1 inch = 10 feet
Horizontal Scale: 1 inch = 10 inches

ORIGINAL
(Red)

ATTACHMENT 4

rapher

eological Survey
56-69, shown on
apping on this

GROUNDWATER CONTOUR MAP
OF CARBONATE ROCKS WITH
ASSOCIATED FRACTURES

ORIGINAL
(Red)

75°45'

(Red)

25'

EXPLANATION

Fracture trace

Obtained from aerial photographs; not field checked.

417

-6.8

Well

198

Spring

Number in roman type indicates altitude of water level, in feet above mean sea level. Number and algebraic sign in italics shows net change in water level, in feet.

360

Water-level contour in April 1972

Contour interval 20 feet. Datum is mean sea level.

C

NC

Contact between carbonate and noncarbonate rocks

SITE

CHANGE IN WATER LEVEL SURFACE, APRIL 1972 TO NOVEMBER 1972, IN FEET:

Rise in water level

0-20

Decline in water level

0-5

5-10

10-20

More than 20

ned.

nthrown side.

l movement.

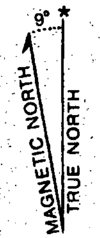
Accuracy not

Overturned

edding

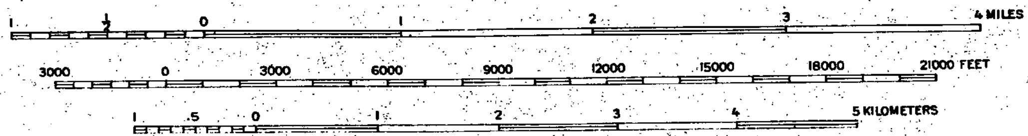
number

number

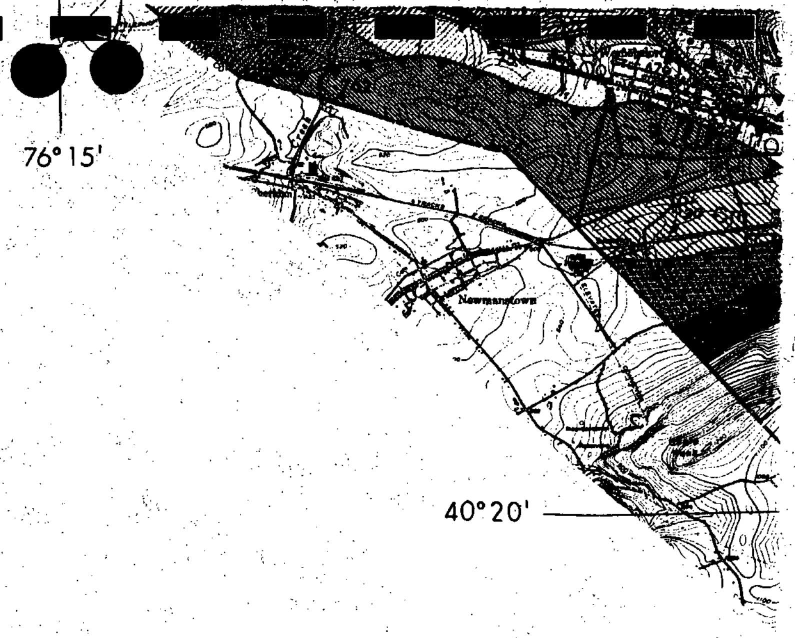


APPROXIMATE MEAN
DECLINATION, 1968

SCALE 1:62500



CONTOUR INTERVAL 10 AND 20 FEET
DATUM IS MEAN SEA LEVEL



Lajos
Cartog

Base
maps,
index
plate.

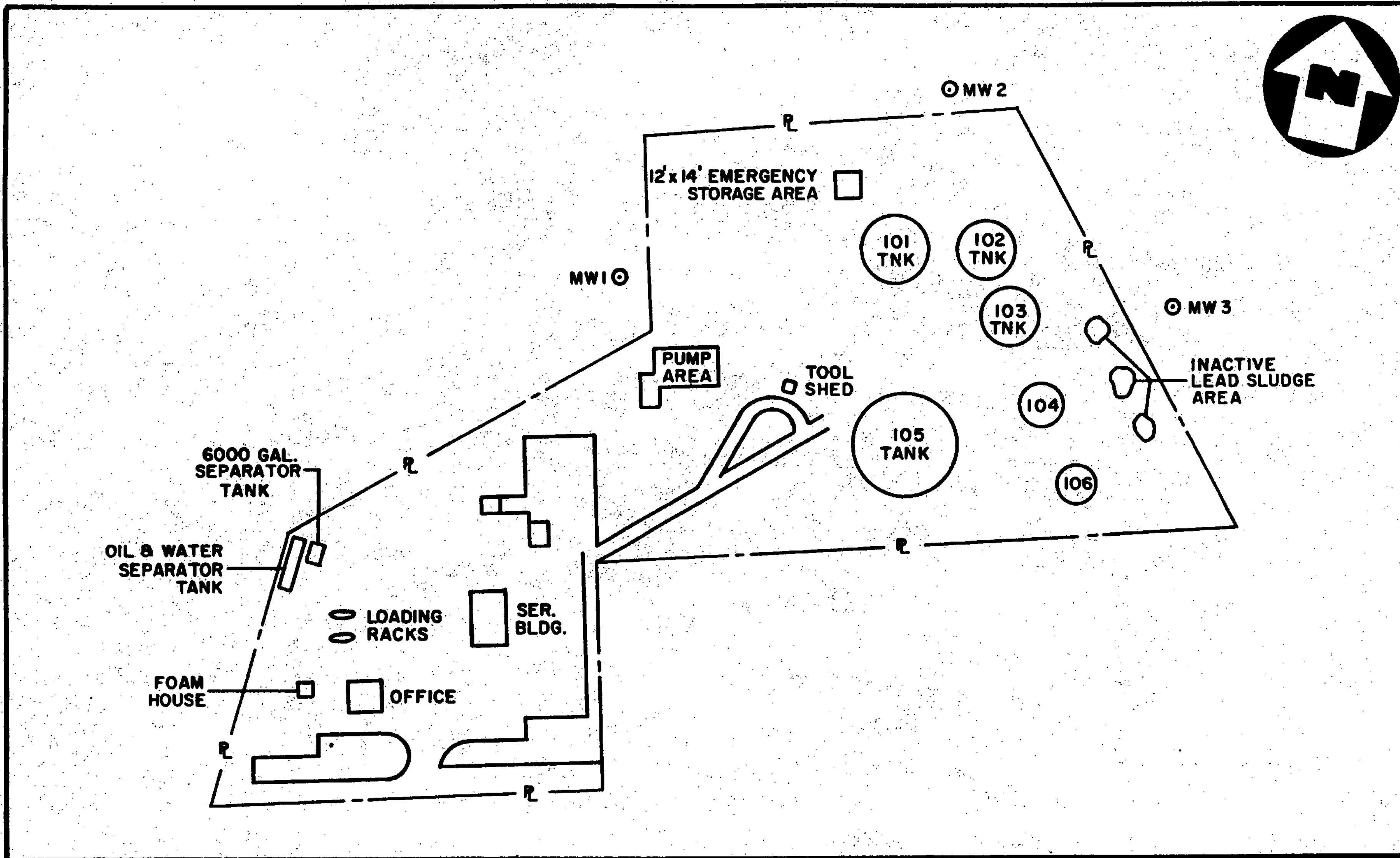
ORIGINAL
(Red)

ORIGINAL
(Red)

ATTACHMENT 5

ORIGINAL
(Red)

AVAILABLE IN EPA FILES



SITE SKETCH

GULF OIL-SINKING SPRING TERMINAL, SINKING SPRING, PA.

(NO SCALE)

FIGURE 2

NUS CORPORATION

A Halliburton Company

ORIGINAL (Red)

ORIGINAL
(Red)

ATTACHMENT 6

SUMMARY OF WELL INFORMATION

CITIZENS UTILITY
WATER COMPANY

TDD NO. F3-8508-09
SITE GULF OIL SINKING SPRING

Well No.	Be-192 2	Be-201 11	Be-202 12	Be-203 13	Be-206 16	17A	Be-422 18A	Be-423 19	20	21
LOCATION	Mt. HOME RD	N. Slope Gr. Hills off Old Fritytown Rd.	Same AS #11	SAME AS #11	Off OLD Frity T. Rd - near Columbia Ave	Reedy Rd.		MERIT PKy	Skeleton Dr. Wyomissing Hills	Papermill Rd Spring Twp
Latitude & Longitude	40 18 25 76 02 40	40 18 03 76 01 37	40 18 04 76 01 34	40 17 59 76 01 18	40 18 17 76 01 50	40 20 19 76 00 59	40 19 14 76 01 01	40 20 09 76 00 38	40 20 24 75 59 24	40 02 17 75 58 30
YEAR	1971	1938	1941	1930	1960	Redrilled 1979	1965	1968	1967	1977
Well depth (ft.)	233	303	303	500	447	356	272	350	290	532
Diameter (ins.)	10	10	10	8	10	10	12	10	8	12
Depth cased (ft.)					65'					
Depth screened (ft.)					110 175 325					
Depth to consolidated rock (ft.)										
Lithology of major aquifer	Richland Fm.	Richland Fm	Richland Fm	Richland Fm	Millbach Fm	Ontelaunee Fm	Richland Fm.	Epler Fm	Epler Fm.	Richenback Fm
STATIC Water level (ft.)	6		170	169	103	31	41	42	70	80
Yield (gpm)	165	110	375	300	315	500	500	500	400	325
PUMP DEPTH (ft)	100		265	300	150	100	80	100	140	435
DRILLER	Kohl Bros.	Kohl Bros.	Kohl Bros.			Echelberger Drillers	LANE NY Drillers	LANE NY Drillers		

ORIGINAL (Red)

ORIGINAL
(Red)

ATTACHMENT 7

06/04/84
FRDS03

FEDERAL REPORTING DATA SYSTEM
PUBLIC WATER SYSTEM - SERVICE AREA AND SOURCE DATA
PENNSYLVANIA PUBLIC WATER SUPPLIES
SORTED BY REGION, STATE, PWS ID

EPA REGION: 03 SURVEILLANCE STATE: PA PRIMACY: N

PWS ID	MAILING NAME/ADDRESS/TELEPHONE	--CITY/COUNTY--	SERVICE AREA RESI	TOWN	RECR	MOBI	INST	SCHL	MOTL	REST	SERV	CAMP	PICN	LODG	MARN	SKIR	BATH	VISI	HWYR	AIRP	OTHR	OWNR	TYPE	POPULATION SERVED	(000) AVERAGE PRODUCT	SOURCE NAME	CODE	TREATMENTS AERA	PREC	COAG	SEDI	FILT	CORR	SOFT	TAST	IRON	AMMO	FLAD	DISI	OTHR	RES1
3060067	SHILLINGTON BORO-WATER DEPT TOWN HALL SHILLINGTON PA 19607 (215) 777-1338	011	Y																			A	C	12,900	534	WESTERN BERKS	P												Y		
3060068	ORCHARD PARK MOBILE HOME PARK RD 1 BOX 768 C/O MRS NOECKER LEESPORT PA 19533 (215) 926-5521	011				Y																I	C	56	2	WELL 397 FEET	G												Y		
3060069	CITIZENS UTILITIES WATER CO 4 WELLINGTON BLVD WYOMISSING HILLS PA 19610 (215) 678-4545	011	Y																			I	C	21,144	2,010	9 WELLS	G												Y		
3060070	URBAN ACRES MOBILEHOME PARK %FRANK URBANIK RD #1 TEMPLE PA 19560 (215) 929-8120	011				Y																I	C	65	6	WELL	G														
3060071	TEMPLE BORO WATER BUREAU 4835 KUTZTOWN ROAD TEMPLE PA 19560 (215) 921-0351	011	Y																			M	C	1,667	0	CITY OF READING	P														
3060072	TOPTON BORO MUN WATER AUTH 44 WEST KELLER STREET TOPTON PA 19562 (215) 682-2541	011	Y																			A	C	1,830	160	3 WELLS	G												Y		
																										31 SPRINGS	G												Y		
3060073	VALLEY VIEW MHP - WERNERSVILLE C/O MR MICKLIN TUCKERTON ROAD READING PA 19605 (215) 926-2101	011				Y																I	C	78	6	WELL 42FT DEEP	G												Y		

LOCATE STATEMENT:
LOCATE (0) C100 WH C2 EQ PA AND NK C194 NE I:

ORIGINAL
(Red)